

Development of the Network Administration System for the Internet Network of Phetchabun Rajabhat University

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Abstract - The aim of this study is to develop the network administration system for Phetchabun Rajabhat University. The system is open-source software developed in Shell Script on CentOS distribution of Linux operating system. A web application for administration purposes were developed in PHP and the database was based on MySQL. The System development Life Cycle was used in the design and development of the system. The administration system developed in this study was designed for administrators who do not have expertise in network administration; thus the administrators will be able to easily manage internet usage and evaluate the system performance without difficulties under security protected system. The system can be used to handle the following tasks: user and group management, configuring download and upload speed, configuring expiration date for user accounts, modifying log-in screen, title bar, and welcome or error messages, modifying user's guide, and reporting the number of online users and their usage history. The usage history and statistics can be displayed by specifying a period of query (by date and by monthly or yearly). In this study, we used the Black Box Testing method to evaluate the system performance.

The research population of 30 persons were selected from a group of computer experts, network administrators and end users to evaluate the internet control system. The results of evaluation showed that the system performance is good and stable, administration tools are easily to use, network administrators are able to control Internet speed so that the overall performance is improved, the university is able to save budget for proprietary software licenses and also effectively improve security of the network against unauthorized use.

Keywords - Internet Control System, Authentication, Firewall

I. INTRODUCTION

Since the enactment of Thailand's Computer Crime Act, the law requires all Internet Service Providers to maintain a log of users' traffic data for at least 90 days, any service provider who fails to comply with the law shall be liable to a fine [1]. In addition, the Thai government also has a policy to expand the Internet network to educational institutions. The Office of the Higher Education Commission has proposed a plan to develop and expand infrastructures for core

and distributed information networks for education development. The plan aims to cover and support the entire educational institution in order to improve accessibility and ability to use information and communication technology for the country's education and research. This plan helps to fuse gaps between basic and vocational education, and also provides access to sources of knowledge both within the country and abroad [2].

However, some educational institutions in Thailand still has network administration system due to insufficient budget and a lack of knowledge and expertise in network administration. Therefore, we decided to develop the network administration system for Phetchabun Rajabhat University as a model for other educational institutions. By considering our limited budget for system development, we developed the administration system by using open source software and existing hardware in order achieve maximum benefit.

II. OBJECTIVES

1. To develop the network administration system for Phetchabun Rajabhat University as a model for other educational institutions.

2. To demonstrate and evaluate the system performance of the network administration system developed in this study.

III. RESEARCH METHODOLOGY

This study is the operational research that develop the network administration system for Phetchabun Rajabhat University according to the principles of the System Development Life Cycle (SDLC) [3]. The System Development Life Cycle consist of 7 processes of design and development as follows: 1) Understanding the problems, 2) Determining feasibility of the system, 3) Determining system requirements, 4) Analysis and design, 5) Developing the system, 6) Implement and testing, and 7) Evaluating and determining efficiency of the system. The processes can be described in details as follows:

1. **Understanding the Problems of the Network Administration System:** We used questionnaires to collect problems and internet usage behavior from the research population of 30 persons, 5 persons from a group of computer experts and network administrators, and 25 persons from a group of teachers, administrative staffs and students in Phetchabun Rajabhat University.

2. **Determining the Feasibility of the System:** We studied the feasibility of the system based on hardware and software available in Phetchabun Rajabhat University. These two aspects are necessary for the development of the network administration system.

3. **Determining the System Requirements:** We determined the system requirements based on information about software, hardware and internet usage behavior and problems of the network administration system.

4. **Analysis and Design:** We designed the topology and protocols of LAN and wireless LAN connections of the host and clients of the network. The system was designed to distribute Private IP to clients under supervision of network administrators only.

5. **Developing the System:** We developed the system in Shell Script on the CentOS distribution of Linux operating system. We also developed the web application in PHP programming language to manage the internet user database of Phetchabun Rajabhat University in MySQL. Open-source software developed in Thailand and abroad, such as EZ Radius, Dalo Radius, and Hotspot Wi-Fi were used to develop the system. The system was designed to cover important tasks, such as managing internet usage and evaluating the system performance, and was also easy to use because it was designed for administrators who do not have expertise in network administration.

6. **Implement and Testing:** We installed the system developed in this study in a computer service room. The system was

connect to the Internet network of the Phetchabun Rajabhat University to evaluate its performance and integrity. The network administrators must be able to control the system easily by using the web application.

7. Evaluating and Determining Efficiency of the System: We collected questionnaires from the research target of 30 persons consisting of computer experts, network administrators and end-users. The Black-Box Testing Method was used to evaluate the performance of the system based on 4 aspects: 1) Functional Requirement Test for verifying the performance of the system against its requirements, 2) Functional Test for verifying the integrity of the system against its specifications, 3) Usability Test for verifying the user-friendliness of the system, and 4) Performance Test for verifying whether the system is able to achieve required Internet speed or not [4]. The statistical values used to determine the performance of the system are percentage, arithmetic mean (\bar{x}) and standard deviation (SD).

IV. RESULTS

The results of the study are discussed according to the processes of the System Development Life Cycle (SDLC) as follows:

1. Understanding the Problems of the Network Administration System: We found that most of the student of the university use the Internet for entertainment, while teachers and administrative staffs uses the Internet for research and education. We also found several problems, such as low internet connection (Download and Upload), users browsing unfavorable websites, congestion from updating large amount of data into the student database, the university was not able to collect users' traffic data as required by the Computer Crime Act.

2. Determining the Feasibility of the System: We found that the feasibility of the system depends on 2 aspects; hardware and software. However, installation of proprietary license software on a host server is expensive.

We decided to developed and install open-source software on personal computers (PC) acting as the host instead a host server.

3. Determining the System Requirements: Since the system requires a host and clients. We installed CentOS distribution of Linux operating system on the host and install Microsoft Windows on the clients.

4. Analysis and Design: The star topology was used as the design of the network for LAN and Wireless LAN connection. The system used TCP/IP as a protocol to connect between the host server and the client work stations. The Private IP were distributed under the supervision of network administrators. The workflow of the system is shown in the Fig. 1.

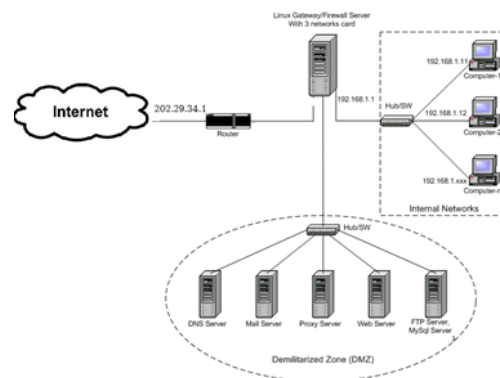


Fig. 1 The Network Administration System for Phetchabun Rajabhat University

The system was connected to the UniNet network with the Internet connection of 1 Gbps using the MAC address of 202.29.34.X. The connection was forwarded to provide the intranet for 2 work station clients. The system was classified into 2 zone as follows:

1) DMZ Server Zone or the host server with an IP address of 202.29.43.2 an IP address of 202.29.34.8 as the host of electronic mail service (Master DNS Mail Server), an IP address of 202.29.34.3 as the host of proxy services, an IP address of 202.29.34.6 as the host of web services, an IP address of 202.29.34.9 as the host of File Transfer Protocol (FTP) to upload and download data.

2) Workstation Zone or clients. Clients were behind the gateway server with an IP

address of 10.1.10.1. The gateway is used connected to the external network and automatically distributed internal IP address for work station clients with the IP address of 10.1.10.X.

5. Developing the System: We developed a web application so that the network administrators can efficiently and easily control internet usage without having expertise in network administration. The system can be used to handle the following tasks: configuring important settings of the system, user and group management, configuring download and upload speed, configuring expiration date for user accounts, modifying log-in screen, modifying passwords of network administrators, automatic IP address distribution, providing proxy services, blocking access to unfavorable websites, provide the coordinated universal time service, and reporting the number of online users and their usage history.

6. Implement and Testing: We found that network administrator could easily use the system to control internet usage without having expertise in network administration because the graphic user interface was user-friendly. The system was stable and able to support congestion without fail. After we controlled bandwidth of download and upload speed, we found that the overall performance of the network was improved. The system also allowed the university to maintain a log of user’s traffic data for at least 90 days according to the law.

7. Evaluating and Determining Efficiency of the System: The results of evaluation by using the Black-box Testing method performed by the research population of 30 persons selected from computer experts and end-users is discussed as follows:

**TABLE I
RESULTS OF EVALUATION
FROM COMPUTER EXPERTS AND
NETWORK ADMINISTRATORS**

Criteria used in Black Box Testing	\bar{X}	SD	Interpretation
1.Functional Requirement Test	4.41	0.53	Good
2.Functional Test	4.54	0.53	Very Good
3.Usability Test	4.35	0.45	Good
4.Performance Test	4.44	0.49	Good
Overall results	4.44	0.50	Good

According to the Table I, this research found that the overall results made by computer experts and network administrators is good level.

**TABLE II
RESULTS OF EVALUATION
FROM END-USERS**

Criteria used in Black Box Testing	\bar{X}	SD	Interpretation
1.Functional Requirement Test	4.33	0.48	Good
2.Functional Test	4.52	0.48	Very Good
3.Usability Test	4.58	0.45	Very Good
4.Performance Test	3.95	0.34	Good
Overall results	4.35	0.44	Good

According to the Table II, this research found that the overall results made by end-users is good level.

V. DISCUSSION AND CONCLUSION

In this study, we developed the network administration system in shell script on CentOS distribution of Linux operating system. PHP programming language is used to develop a web application to store data in the database using MySQL. Our system is able to maintain a log of users’ traffic data for at least 90 days as required by the law [1]. The system is also developed by open-source software; therefore, the university can save cost of proprietary software licenses. This benefit is consistent with the suggestion in “Open Source Software: Freedom of Value Creation and Research Development” that open-source

software requires financial support only in the phrase of development; however, there is no expense for purchasing and maintaining the software [5]. We found that our system could improve the overall internet usage experience because of the user-friendly graphic user interface. The system performance was also improved after we controlled bandwidth of the network [6] also suggested that there are several solutions to handle problems related to insufficient bandwidth as follows: 1) Increase the bandwidth, 2) Define good network usage policies, and 3) Install bandwidth management tools that can prioritize bandwidth for applications that has higher priorities. In our system, the performance was improved due to good network usage policies and installation of bandwidth management tools. We also found that the overall performance evaluated by using the Black-box Testing method yields the good results because network administrators are able to supervise and manage the bandwidth allowed for each group of users with high efficiency and users cannot download or upload data beyond the bandwidth allowed.

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(Arranged in the order of citation in the same fashion as the case of Footnotes.)

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